From biogas to biorefinery: Modelling green chemical production in a full-scale anaerobic digester

Junicke, Helena; Flores-Alsina, Xavier; Pinto, Tiago; Gernaey, Krist V.

Publication date:
2019

Document Version
Peer reviewed version

Conference title:
10th IWA Symposium on Modelling and Integrated Assessment (Watermatex)

Conference scope:
International

Conference date:
1-4 September 2019

Conference place:
Copenhagen, DK

Conference URL:
https://www.conferencemanager.dk/watermatex2019/home.html

Talk title:
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Authors:
Helena Junicke, Xavier Flores-Alsina, Tiago Pinto, Krist V. Gernaey

Abstract:
Industrial waste streams are a versatile feedstock for biorefinery processes. In this work, we study the upgrading of such feedstock into butanol, a valuable chemical and promising biofuel. The Anaerobic Digestion Model No. 1 (ADM1) was extended with butanol-forming reactions, thermodynamics and butanol gas-liquid mass transfer. Continuous butanol production was modelled in a full-scale anaerobic digester. ADM1 without thermodynamic constraints overestimates butanol productivity by 121% as compared to the thermodynamics based implementation. The highest butanol productivity (2.6 MWh.d-1) was obtained at pH 5 with a COD recovery of 12%. Results lead us to propose a two-stage biorefinery process for butanol/methane production.